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(54) AN IMPROVED APPARATUS AND METHOD FOR CONVEYING EXPLOSIVE SLURRIES TO BORE HOLES

(71) We. ICI AUSTRALIA LIMITED of 1 Nicholson Street, Melbourne, Australia, a Company organised and existing under the laws of the State of Victoria, Commonwealth of Australia, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

It is common practice to supply explosive slurries to boreholes through flexible pipelines, often of internal diameter as small as 2 or 3 cm. As the pipelines may be 100 m. or more in length, and as the slurries often include cross-linking agents to cause them to gel in order to minimise the effect of water in the borehole, the slurries frequently begin to gel before leaving the pipeline so that a great deal of power is expended in pumping the slurries into the borehole.

It is the principal object of the present invention to provide apparatus for combination with a pipeline for conveying explosive slurries to boreholes whereby the residence time of cross-linked slurries in the pipeline is minimised.

In order to achieve the above stated principal object, the present invention provides apparatus in combination with a flexible supply pipeline for conveying explosive slurry to a borehole, the apparatus comprising a rigid open-ended tubular member of approximately the same diameter as the pipeline and mounted as a collinear extension on the discharge end of the pipeline, a turbine mounted within the said tubular member for rotation by the flow of slurry explosive through the said tubular member, a rotatable stirrer mounted for rotation with the turbine and located within the said tubular member at the end thereof remote from the pipeline, and an inner tube of external diameter small in relation to the internal diameter of the pipeline for the supply of cross-linking agent for the slurry explosive, the said inner tube extending along and within the pipeline to terminate in an outlet within the said tubular member between the pipeline and the stirrer.

The present invention also provides a method of supplying cross-linked explosive slurries to the interior of narrow boreholes, wherein an explosive slurry without cross-linking agent incorporated therein is pumped through a pipeline having at the discharge end the aforedescribed apparatus of the invention, and wherein a cross-linking agent is supplied through the inner tube of the said apparatus.

The turbine is preferably a strip of material twisted about its longitudinal axis to resemble an auger extending internally along the said tubular member over part of the length of the tubular member.

For convenience in manufacture and assembly, the tubular member is preferably formed in two parts which are detachably connected together in longitudinal alignment.

The area of the outlet aperture from the inner tube is preferably adjustable.

One practical arrangement of an apparatus according to the present invention will now be described with reference to the accompanying drawings. In these drawings:

Fig. 1 is a side elevation;

Fig. 2 is a cross-section on the line 2-2 of Fig. 1; and

Fig. 3 is a cross-section on the line 3-3 of Fig. 1.

Referring now to the drawings, the pipeline comprises a flexible rubber pipe 4 three cm. in external diameter to convey explosive slurry from a point of supply to a borehole. Fixed to the end of the pipe in alignment therewith is a metal tubular member 5 four cm. in external diameter and 27 cm. in length. A turbine 6, 25 cm. in length, constituted by a metal strip twisted about its longitudinal axis fits neatly within the

tubular member 5 and terminates in an axial arbor 7 at the end remote from the pipe 4. The arbor 7 extends through a central bearing 8 supported by a spider 9 mounted at the end of the member 5 within a further metal tubular member 10 four cm. in external diameter and 11 cm. in length screwed on to the end of the member 5 in alignment therewith. The arbor 7 is fixed to the central shaft 11 of a stirrer 12, 7 cm. in length, having banks of radial vanes 13 fixed to the shaft at approximately 1 cm. intervals. The stirrer 11 is wholly located within the member 10.

A nylon tube 14 one half cm. in external diameter extends within and along the pipe 4, to terminate in an outlet 15 fixed by a spider 16 within the member 5, at the end of the turbine 6 adjacent to the pipe 4. A needle valve 17 permits adjustment of the area of the outlet aperture.

In use, slurry devoid of cross-linking agent is pumped along the pipe 4 and through the tubular member 5, thereby rotating the turbine 6 and stirrer 12. Cross-linking agent is pumped through the inner tube 14 to pass with the slurry along the turbine 6 and to be mixed with the slurry by the stirrer 12 immediately before emerging from the tubular member 10 into the borehole.

WHAT WE CLAIM IS:—

1. Apparatus in combination with a flexible supply pipeline for conveying explosive slurry to a borehole, the apparatus comprising a rigid open-ended tubular member of approximately the same diameter as the pipeline and mounted as a collinear extension on the discharge end of the pipeline, a turbine mounted within the said tubular member for rotation by the flow of slurry explosive through the said tubular member, a rotatable stirrer mounted for rotation with the turbine and located within the said tubular member at the end thereof remote from the pipeline, and an inner tube of external diameter small in relation to the internal diameter of the pipeline for the supply of cross-linking agent for the slurry explosive, the said inner tube extending along and within the pipeline to terminate in an outlet within the said tubular member between the pipeline and the stirrer.

2. An apparatus according to claim 1, wherein the area of the outlet aperture from the tube is adjustable.

3. A method of supplying cross-linked explosive slurries to the interior of narrow boreholes, wherein an explosive slurry without cross-linking agent incorporated therein is pumped through a pipeline having at the discharge end of an apparatus as claimed in claim 1 or claim 2 and wherein a cross-linking agent is supplied through the inner tube of said apparatus.

4. An apparatus substantially as herein described with reference to and as illustrated by the accompanying drawings.

5. A method of supplying cross-linked explosive slurry to a borehole substantially as herein described with reference to the accompanying drawings.

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1 SHEET *This drawing is a reproduction of the Original on a reduced scale*

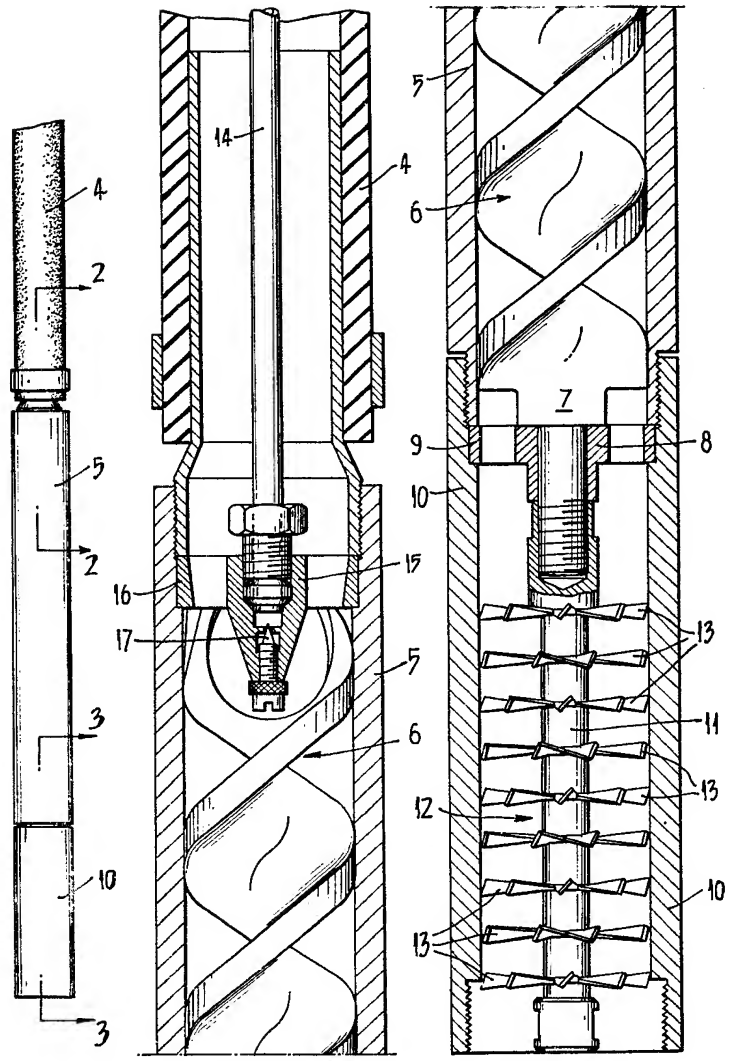

FIG. 1. FIG. 2. FIG. 3.